

### **REMARKS/ARGUMENTS**

In view of the foregoing amendments and following remarks, favorable reconsideration of the pending claims is respectfully requested.

#### ***Status of the claims***

Claims 1-6, 8-12, 14, 15, and 26 are currently pending. Claims 7, 13, and 16-25 have been cancelled.

Claim 1 has been amended as suggest by the Examiner.

#### ***Prior Art Rejections***

Claims 1-6, 8-12, 14, 15, and 26 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Baines, Musow, Hultman, Engdahl, and newly cited Canadian Patent No. 1198558 to Bertelsen. The Office Action relies on Baines for the teaching of using a computer to control a causticization and that the computer can monitor any parameter characteristic of the system. The Office Action relies on Musow for teaching that variables can be measured in the causticizing system. The Office Action relies Hultman for allegedly teaching the measurement of green density and control of white infeed. The Office Action asserts that Engdahl teaches the addition of white liquor to the process. The Examiner has taken the position that the workings of how a computer system works and makes calculations is conventional and it would therefore be obvious to use a computer to monitor the density or alkali in the process of Baines because doing so asserts control over the process for monitoring for optimum results.

#### ***Argument.***

The Examiner has failed to make a prima facie case of obviousness because 1) the combination of references fails to teach each and every claim element and 2) because there is no motivation to combine the references. Specifically, the combination of references fails to teach at least any one of the following:

- a. adding white liquor to the green liquor stream being fed into the slaker;
- b. calculating a set value for the density of the green liquor based on a model that relates total titratable alkali (TTA) to green liquor density; or

c. controlling the density of the green liquor using measurements for the green liquor density and measurements for TTA of the green liquor.

**1. The Combination of Baines, Musow, Hultman, and Engdahl Do Not Disclose or Suggest Each and Every Element of Claim 1.**

Applicants respectfully submit that the combination of Baines, Musow, Hultman, Engdahl, and Bertelsen fails to disclose or suggest the claimed invention. Specifically, the combination of the cited references fails to disclose or suggest any of the following steps that are recited in Claim 1:

- a. controlling the amount of white liquor added to green liquor to thereby control the density of the green liquor being fed to the slaker towards a set value;
- b. calculating the set value for the density of the green liquor based on the measured total titratable alkali in the green liquor, a target value for the total titratable alkali, and a model that relates green liquor density to the measured total titratable alkali in the green liquor; or
- c. controlling the density of the green liquor using both a measured density of the green liquor and the measured titratable alkali in the green liquor.

As discussed in greater below, the Office has failed to establish how the combination of references teach any of the above elements.

*a. The combination of references do not teach controlling the amount of white liquor added to green liquor to thereby control the density of the green liquor being fed to the slaker towards a set value.*

The cited references do not disclose or suggest controlling the amount of white liquor added to green liquor to thereby control the density of the green liquor being fed to the slaker towards a set value. Musow describes a process wherein the causticization process is controlled by adjusting the amount of weak wash solution that is added to the dissolving tank so that the concentration of sodium carbonate in the green liquor is maintained at a pre-determined level. See column 2, lines 27 – 33. For example, FIG. 1 specifically illustrates a schematic of the system wherein the weak wash 16 is added to the dissolving tank 14. There is no disclosure or suggestion in Musow of adding the weak wash to the green liquor after it has exited the

dissolving tank. This process is significantly different than the process recited in Claim 1 because the weak wash in Musow is being added to the dissolving tank in which the smelt is being dissolved. In contrast, the claimed invention recites that the white liquor is added to the green liquor after the dissolving process is complete and the green liquor has already been produced.

Baines is directed to a method of controlling the causticizing process by controlling the amount of lime that is introduced into the slaker. See column 5, lines 50-51. For example, Baines states that the “introduction of lime, CaO, to the slaker is the critical point of control.” See column 5, lines 48-49. Thus, Baines also does not disclose or suggest the step of controlling the density of the green liquor by controlling the amount of white liquor added to the green liquor.

Hultman, as in Baines, is directed to a process in which the causticization process is controlled by controlling the amount of calcium oxide (lime) that is added to the slaker. In particular, Hultman teaches that in order to better control the causticization process, variations in the quality of the lime being fed into the slaker must be accounted for so that adjustments to the quantity of lime be fed to the slaker can be made. Hultman accomplishes this by estimating the flow of carbonate ion per unit time in both the green and white liquors. See column 4, lines 25 – 40. From this information, “the flow of calcium oxide per unit time can be proportioned in accordance with the flow of carbonate ion in the green and white liquor.” See *Id.* Thus, according to the process described in Hultman “one determines the carbonate ion concentration of the starting green liquor, and the carbonate ion content of the causticized white liquor, and then controls the addition of calcium oxide to the green liquor accordingly to maintain the degree of causticization within a predetermined range.” See column 3, lines 7 – 28 (emphasis added). Thus, as in Baines, Hultman also fails to disclose or suggest the step of controlling the density of the green liquor by controlling the amount of white liquor added to the green liquor.

The Examiner alleges that “Hultman teaches the measurement of green density and control of white infeed.” However, the Examiner does not even attempt to indicate where support for such a statement can be found in Hultman. In the Final Office Action, the Examiner cites to column 1, lines 20 – 25 and column 10, lines 10 – 15 of Hultman without any further explanation. If the Examiner is relying on the cited excerpts for support of his assertions, his

reliance is misplaced. Column 1, lines 20 – 25 describes that white liquor is used to pulp lignocellulosic material in a digester. This describes a portion of a conventional process for digesting pulp; it is completely silent with respect to recovery of white liquor, let alone the step of adding white liquor to the green liquor stream being fed into the slaker. Column 10, lines 10 – 15 describes that the amount of lime added to the slaker was manually controlled by measuring carbonate ion concentration in the green liquor and white liquors to determine the extent of causticization obtained. As noted above, these values are used to control the addition of calcium oxide to the green liquor to maintain the degree of causticization within a predetermined range. See column 3, lines 7 – 28. The cited excerpts are completely silent with respect to controlling the density of the green liquor by controlling the amount of white liquor added to the green liquor. Accordingly, Hultman fails to disclose or suggest the step of controlling the density of the green liquor by controlling the amount of white liquor added to the green liquor.

Contrary to the Examiner's assertions, Engdahl does not describe a process in which white liquor is added to the green liquor. Rather, Engdahl describes a process in which white liquor itself is slaked with the lime to produce a combination of slaked lime and white liquor. It is to this combination to which the green liquor is added. In a subsequent step, the white liquor containing the slaked lime is mixed with green liquor and sent to a tank where causticization of the slaked lime occurs. See column 2, line 55 – column 3, line 25. The resulting white liquor (i.e., the original white liquor and that which is a product of the reaction between the slaked lime and the green liquor) is separated into a stream to be used in the Kraft process and a stream that is to be used in the lime slaking process discussed above.

Further, Engdahl does not disclose or suggest controlling the density of the green liquor being added to the slaker, or any desirability of doing so. As such, Engdahl can certainly not disclose or suggest the step of controlling the density of the green liquor by controlling the amount of white liquor added to the green liquor. Accordingly, Engdahl also fails to disclose or suggest the step of controlling the density of the green liquor by controlling the amount of white liquor added to the green liquor.

Bertelsen also fails to disclose or suggest a process in which white liquor is added to the green liquor to control the causticization, or controlling the density of the green liquor being added to the slaker, or any desirability of doing so. Rather, Bertelsen discloses controlling the

TTA value and simultaneously hoping that the density changes in a desired way. In other words, the process of Bertelsen presumes a linear relationship between density and TTA. However, such methods do not provide for accurate control of the causticization process.

The processes described in the cited references are completely different than the claimed process in which density of the green liquor is controlled to a set value by controlling the amount of white liquor is added to the green liquor. None of the cited references disclose or suggest adding white liquor to the green liquor, and therefore do not disclose or suggest the step of controlling the amount of white liquor added to the green liquor to thereby control the density of the green liquor being fed to the slaker towards a set value. Accordingly, the combination of the references cannot disclose or suggest this step.

***b. The combination of references do not teach the step of calculating a set value for the density of the green liquor based on a model that relates total titratable alkali (TTA) to green liquor density.***

The combination of the cited references also does not disclose or suggest the step of calculating a set-value for the green liquor density to be introduced into the slaker based on the measured TTA of the green liquor, a target value for the TTA, and a model that relates the measured TTA in the green liquor to the green liquor density. As discussed above, Claim 1 recites that the step of specifying the set value for the green liquor includes the step of determining a target value for the TTA, measuring the TTA in the green liquor, providing a model that relates green liquor density to the measured TTA, and calculating the set value based on the measured TTA, target value for the TTA, and the model. In contrast, Musow teaches controlling the causticization reaction by maintaining the concentration of the sodium carbonate at a desired level. Musow does not teach the step of determining a set value for the density, let-alone the step of calculating the set-value using a target TTA, the measured TTA, and a model that relates the measured TTA to density of the green liquor. Baines also fails to teach these steps. In contrast, Baines teaches that the amount of lime that is to be added to the slaker may be determined by measuring concentrations of the primary constituents of the green liquor and the white liquor: carbonate, hydroxide, and sulfide. These components are individually measured to provide the control system with a complete characterization of the reagents participating in the

causticizing reaction so that each individual component may be accounted for by the control system. See column 3, lines 9-15. Thus, Baines also fails to disclose or suggest the step of determining a set value for the density, let-alone the step of calculating the set-value using a target TTA, the measured TTA, and a model that relates the measured TTA to density of the green liquor.

Hultman, Engdahl and Bertelsen similarly fail to disclose or suggest the step of calculating a set value for the density of the green liquor based on a model that relates total titratable alkali (TTA) to green liquor density. In particular, Hultman fails to disclose or suggest a process in which the amount of white liquor added to the green liquor is determined based on the measured TTA of the green liquor, a target value for the TTA, and a model that relates the measured TTA in the green liquor to the green liquor density.

As noted above, Engdahl does not disclose or suggest controlling the density of the green liquor being added to the slaker, or any desirability of doing so. In fact, there would be no motivation to do so because in the process of Engdahl, the white liquor already contains the slaked lime prior to the introduction of the green liquor. Since Engdahl does not disclose or suggest controlling the density of the green liquor, it certainly does not disclose a process in which the amount of white liquor added to the green liquor is determined by based on the measured TTA of the green liquor, a target value for the TTA, and a model that relates the measured TTA in the green liquor to the green liquor density. In fact, Engdahl is completely silent with respect to measuring parameters, such TTA, density, and the like. Accordingly, Hultman and Engdahl also fail to disclose or suggest the step of calculating a set value for the density of the green liquor based on a model that relates total titratable alkali (TTA) to green liquor density.

Bertelsen also fails to disclose or suggest a process in which the density and TTA of the green liquor being fed to the slaker is measured, and a set value for the density of the green liquor is determined based on a model that relates total titratable alkali (TTA) to green liquor density. Accordingly, Bertelsen also fails to disclose or suggest the step of calculating a set value for the density of the green liquor based on a model that relates total titratable alkali (TTA) to green liquor density.

In maintaining the rejection, the Examiner relies on Baines for the use of a computer system for controlling the causticizing process, and that it would therefore be obvious to use the computerized process described in Baines in combination with the claimed variables because Musow teaches that different variables can be monitored. For example, the Examiner in the Final Office Action dated January 3, 2006 states that "the claims are an indirect way of performing the control exerted more directly by the references [and that] this is an obvious expedient, given a known and well characterized reaction system and relationships between the species...." In essence the Examiner is asserting the invention is obvious because computer systems are known, measuring density is known, and measuring TTA is known. Further, the Examiner's arguments show that he has narrowed the claimed invention down to what he perceives as the "gist" of the invention, i.e., measuring TTA and density of the green liquor. This can surely not be the standard by which proper rejections are made.

In addition, the Examiner's reasoning completely ignores or conveniently overlooks how the TTA and the density of the green liquor are used in the method steps recited in Claim 1. For example, the Examiner has not addressed where the references disclose or suggest the steps of 1) specifying a set-value for the green liquor by: 2) determining a target value for the TTA; 3) providing a model that relates green liquor density to the measured TTA; and 4) calculating the set value for the green liquor density based on the measured TTA of the green liquor, the target value for the TTA, and the model. The Examiner has not provided a reasonable basis for where these method steps can be found in the combination of the cited references. Rather, the Examiner attempts to compensate for these deficiencies by making broad statements that the workings of how the computer makes calculations are deemed conventional and that the differences between the references and claims is which variables are monitored without every providing analysis of how the cited references disclose or suggest the recited method steps. In other words, the Examiner has failed to ascertain the differences between the prior art and the claimed invention because the Examiner has narrowly focused on the parameters of measuring TTA and density while completely ignoring the actual method steps recited in the claims. Thus, the Examiner has failed to compare the actual teachings of the references to the claims and has therefore failed to follow the standard for making an obviousness rejection as articulated by the *Supreme Court in Graham v. John Deere*, 383 U.S. 1 (1966): i.e., ascertaining the differences

between the prior art and the claims in issue. This is not the proper inquiry in making an obvious rejection.

*c. The combination of references do not teach the step of controlling the density of the green liquor using both a measured density of the green liquor and the measured titratable alkali in the green liquor.*

Further, the combination of the references fails to disclose or suggest the step of controlling the density of the green liquor using both a measured density of the green liquor and the measured titratable alkali in the green liquor. As discussed above, Musow teaches measuring the concentration of sodium carbonate of a green liquor in the dissolving tank. See column 2, lines 44 – 48. Baines on the other hand, teaches that the amount of lime that is to be added to the slaker may be determined by measuring concentrations of the primary constituents of the green liquor and the white liquor: carbonate, hydroxide, and sulfide. These components are individually measured to provide the control system with a complete characterization of the reagents participating in the causticizing reaction so that each individual component may be accounted for by the control system. See column 3, lines 9-15. Thus, neither Musow nor Baines disclose the step of controlling the density of the green liquor using both a measured density of the green liquor and the measured titratable alkali in the green liquor. As noted above, Hultman, Engdahl, and Bertelsen also fail to disclose this step. Thus, the combination of Musow and Baines, with or without the teachings of Hultman, Engdahl or Bertelsen, fails to disclose or suggest the step of controlling the density of the green liquor using both a measured density of the green liquor and the measured titratable alkali in the green liquor.

For the reasons set forth above, Applicants respectfully submit that the combination of Baines, Musow, Hultman, Engdahl, and Bertelsen fails to disclose or suggest each and every element recited in Claim 1. Applicants respectfully request that this rejection be withdrawn.



**2. The Combination of Baines, Musow, Hultman, Engdahl, and Bertelsen Does Not Disclose or Suggest Each and Every Element of Dependent Claim 11.**

Claim 11, which is dependent on Claim 1, recites that the density of the green liquor is calculated according to the following equation:

recites that the green liquor density is controlled on the basis of a total titratable alkali by applying the following equation:

$$D = (TTA + os) / kk,$$

wherein: D is the green liquor density;

TTA is the total titratable alkali of the green liquor;

os is an offset; and

kk is a constant angular coefficient, wherein the coefficient is a constant angular coefficient the value of which is between 0.9 and 1.4 when the unit used for expressing the TTA and the density is the same,

the offset being determined on the basis of the model.

None of the cited references disclose or suggest the above recited equation. The Examiner has failed to show where the equation and its various variables can be found in the references. In maintaining the rejection, the Examiner relies on vague statements that the workings of how the computer makes calculations are known and therefore it would be obvious to use the equation recited in Claim 11. However, such statements cannot support an obviousness rejection. If the Examiner's assertion was true, it is a wonder that any additional patents utilizing mathematical equations and computers could ever be obtained. The Examiner has the burden of showing where the equation recited in Claim 11 is disclosed or suggested in the cited references. In the present case, it is respectfully submitted that the Examiner has failed to meet this burden.

**3. The Combination of Baines, Musow, Hultman, Engdahl, and Bertelsen Does Not Disclose or Suggest Each and Every Element of Independent Claim 26.**

Independent Claim 26 recites a process for controlling the causticizing reaction in which the set value for the green liquor density is determined utilizing the following equation:

$$D = (TTA + os) / kk,$$

wherein: D is the green liquor density;

TTA is the total titratable alkali of the green liquor;

os is an offset, which is determined using a model having as parameters the green liquor TTA and momentary density of green liquor; and

kk is a constant angular coefficient, wherein the coefficient is a constant angular coefficient the value of which is between 0.9 and 1.4 when the unit used for expressing the TTA and the density is the same.

The process recited in Claim 26 utilizes variables for the TTA of the green liquor, a constant angular coefficient "kk", and an offset "os" that is determined from a model having parameters for the green liquor TTA and the momentary density of the green liquor. For the same reasons discussed above, the cited references also fail to disclose or suggest the above-equation, which is recited in Claim 26. As discussed above, the Examiner has failed to show where the equation and its various variables can be found in the references.

Additionally, the cited references also fail to disclose or suggest the step of introducing an effective amount of a white liquor stream into the green liquor as recited in Claim 26. For example, the cited references disclose controlling the causticizing process by adding lime to the slaker or weak white liquor to the dissolving tank, which is discussed in greater detail above.

Thus, the combination of the cited references also fails to disclose or suggest each and every element recited in Claim 26. Accordingly, it is respectfully submitted that Claim 26 is patentable over the rejection of record.

#### **4. There is no Motivation to Combine the teachings of Baines and Musow**

Applicants respectfully submit that one of ordinary skill in the art would have no motivation to combine Baines and Musow in the manner contemplated by the Examiner. Specifically, neither Baines nor Musow provide the motivation to combine the computer process of Baines with variable measurements described in Musow. Further, one of ordinary skill in the art would not expect that the references can be combined in a predictable manner.

First, the methods described in Musow and Baines are completely different from each other. Baines teaches controlling the amount of lime added to the slaker, whereas Musow

teaches maintaining the sodium carbonate concentration at a desired concentration by adjusting the amount of weak wash solution that is added to the dissolving tank. These steps utilize different methods and different chemical reactions for controlling the causticizing reaction, and occur at completely separated points in the Kraft process. As such, one of ordinary skill in the art would not be motivated to select disparate and unrelated elements from Baines to be combined with unconnected elements of Musow.

As noted above, Musow teaches regulating the sodium carbonate concentration of a green liquor in a dissolving tank by measuring conductivity of the green liquor in the dissolving tank. See e.g., column 2, lines 44 – 47. In particular, Musow teaches calculating the concentration of a single component, e.g., utilizing conductivity measurements, to maintain a desired level of sodium carbonate within the green liquor.

In sharp contrast, Baines includes multiple statements that teach away from using measurements, such as conductivity, in controlling the causticizing reaction. First, Baines repeatedly emphasizes that using a single characteristic, such  $\text{Na}_2\text{CO}_3$  concentration, conductivity, TTA, or density, in controlling the causticization reaction provides less accuracy and therefore is undesirable. For example, Baines states that “a measurement of a single characteristic of the entire white or green liquor, as taught by Bertelsen, can result in error...” See column 2, lines 27-29. Baines further elaborates that “Bertelsen teaches that the progress of the causticizing reaction can be measured by making a differential conductivity measurement.” See column 2, lines 17 – 19. From these excerpts, it can be seen that Baines clearly teaches away from the process described in Musow, and away from using measurements, such as TTA or density, as recited in the claimed process. Baines further states at column 6, lines 10 – 14 that [r]ather it is the determination of the relative concentrations of the liquor components, as opposed to a measurement of a characteristic of the total liquor that is important to the methods of the present invention.” Thus, the teachings of Baines include numerous statements that would teach away from the combination of Baines and Musow.

Hultman, Engdahl, and Bertelsen also fail to provide the necessary motivation to combine the references. Engdahl is completely silent with respect to measurements, such as density, TTA, and the like. Hultman describes measuring carbonate ion concentration of the starting green liquor, and the carbonate ion content of the causticized white liquor to determine how

much lime is to be added to the slaker. As discussed above, Baines teaches against using such measurements. In fact, Baines specifically teaches the undesirability of the method described in Hultman. For example, Baines states that the “the Hultman method measures only a sample of the liquor. The measurement is relatively complex in that it involves introducing an additional reaction to create a by-product, CO<sub>2</sub>, that can be measured. The measurement of CO<sub>2</sub> is not directly related to the causticizing reaction and is therefore only an inferred measurement.” See column 2, lines 8 – 14. Thus, Baines clearly teaches away from the process described in Hultman and one of ordinary skill in the art would not be motivated to modify the process of Baines to include measuring single components of the green and white liquors as taught in Hultman.

It is clear that Baines goes to great extent to distance the process described therein from the teachings of Musow and Hultman, which utilize a single measurement, such as conductivity or carbonate ion concentration, to control the causticization process. In light of this clear teaching away from Musow and Hultman, there would be no motivation to combine the teachings of Baines with either Musow or Hultman in the manner contemplated by the Examiner. For this additional reason, Applicants respectfully request that the Board overturn the rejection of record.

Further, one of ordinary skill in the art would not expect that the measurements of Musow or any of the other cited references could be successfully combined with the teachings of Baines to arrive at the claimed invention. In fact, the teachings of these references lead to the conclusion that they cannot be combined in a predictable manner. In other words, one of ordinary skill in the art would not predict that Baines could successfully be combined with any one of Musow, Hultman, Engdahl, or Bertelsen to provide a process that facilitates control over the causticizing process because Baines specifically teaches against using the measurements described in these references. For this additional reason, the rejections based on the combination of Baines Musow, Hultman, Engdahl, and Bertelsen should be withdrawn.

Further, Musow also teaches away from the claimed invention. Specifically, Musow states that conductivity measurements are superior and more accurate than indirect measurements such as TTA measurements of the green liquor. For example, Musow states “[t]he above-described method regulates sodium carbonate concentration based on

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Amdt. dated 11/18/2008  
Reply to Office Action of 07/18/2008

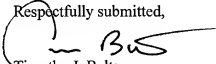
measurements that are more accurate than such indirect measures as density of the green liquor or total titratable alkali in the green liquor.” See e.g., column 2, lines 58 – 63. By teaching that TTA measurements are inferior, Musow teaches away from using TTA measurements of a green liquor for control purposes, and one of ordinary skill in the art would not be motivated to combine the conductivity measurements, or even TTA measurements, of Musow with a control system such as the Baines system. Thus, one of ordinary skill in the art would not be motivated to combine Baines and Musow with each other or with Bertelsen.

In maintaining the rejections, the Examiner has repeatedly ignored the multiple teachings in both Baines and Musow that teach away from the claimed invention and teach away from the combination of Baines and Musow. Therefore, it is respectfully requested that the rejections of the claims based on the combination of Baines, Musow, Hultman, Engdahl, and Bertelsen be withdrawn.

#### ***Conclusion***

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,



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